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PSYCHE

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ANTS OF THE GENERA MYOPIAS AND ACANTHOPONERA.[1]

By William Morton Wheeler.

A recent study of the Australian ants collected some years ago by Mr. A. M. Lee and myself has led me to revise the Ponerine genera Myopias and Acanthoponera, two groups of more than usual interest on account of their singular geographical distribution. The former genus was established by Roger[2] more than 60 years ago for a Ceylonese ant, *M. amblyops*, which has not been taken since, although considerable thorough collecting has been done in India and Ceylon. A second species was brought to light in New Guinea by L. Biró and described in 1901 by Emery as *M. cribriceps*[3]. A third species has now been discovered by Mr. Lea in Tasmania and is described in the sequel. The highly vestigial eyes in the workers of these ants show that they are subterranean in habit, but they must be extremely rare, since a total of only eleven specimens has been seen. Their recorded distribution is so discontinuous that we may regard them as vanishing relicts of forms very close to the direct ancestors of Trapeziopelta, a genus represented by a number of species in the East Indies and New Guinea.

The distribution of Acanthoponera is even more interesting. It comprises two species in Australia, one in New Zealand and five in the Neotropical Region, from Chile, Argentina and Brazil to Central America and Mexico. All the American species occur in the southern portion of the range and the forms in Central America and Mexico are merely small varieties or subspecies which have strayed beyond the optimum environ-

[1]Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 230.

[2]Berlin. Entom. Zeitschr. 5, 1861, p. 39.

[3]Termeszetr. Fuzet. 25, 1901, p. 156.

ment. The American forms, moreover, may be readily separated into two groups, one of which, including *A. mucronata* Roger, the type of the genus, and *goeldii* Forel, have tridentate claws and long epinotal spines, while the other, including the remaining species, *carinifrons* Mayr, *dentinodis* Mayr and *dolo* Roger, have, like the Australian forms, simple claws and a merely dentate epinotum. In my opinion, the latter group should be regarded as a distinct subgenus, for which I suggest the name **Anacanthoponera** subgen. nov., with *Ponera dolo* Roger as the type.

Few groups of ants resemble Acanthoponera in having an "antarctic" distribution. Perhaps the best example is the subgenus Notomyrmex of the genus Monomorium, which is represented by a number of species in Australia, New Caledonia, Lord Howe Island, Norfolk Island, New Zealand, a few in Patagonia and Chile and, according to Emery, also a few in Madagascar and East Africa. Mann's subgenus Fulakora, a group of species of the archaic genus Stigmatomma, with approximated frontal carinæ, may also be cited in this connection because it is represented in the East Indies, Solomon Islands, New Zealand, Argentina, Chile and Southern Brazil. The Chilean ants of the genus Lasiophanes, which are closely related to those of the genus Prolasius in New Zealand and of Melophorus in Australia afford another example. I might also cite the singular little hypogæic Ponerine ants of the genus Discothyrea, of which a few species occur in the East Indies, one in New Zealand, one of a closely allied genus, Prodiscothyrea, in Australia, a species recently discovered by Bruch in Argentina, one in Kamerun, one in Columbia and one which was described by Roger in 1863 from "North America", but which has never been taken since. Apart from its occurrence in Africa, the distribution of this genus is not unlike that of Iridomyrmex, though the latter is represented by many species in Australia and is absent from New Zealand, though occurring on Norfolk Island, in the Neotropical Region and as far north as our southern states. When we consult the fossil record, however, we find that the two genera last mentioned were represented by species of Bradyponera and Iridomyrmex respectively in the Baltic amber

and this suggests that they were cosmopolitan groups, possibly of northern origin, which now survive in the tropics and mainly in the southern hemisphere. I maintain, therefore, that the same explanation may account for the present peculiar and restricted distribution of Acanthoponera, Notomyrmex and Fulakora, since these, too, may have had a northern Eurasian origin during Cretaceous or early Tertiary times. Mann has recently discovered in Bolivia a species of the archaic Ponerine genus Probolomyrmex (*P. boliviensis*)[1], previously known only from a species in South Africa (*P. filiformis* Mayr). These, too, in my opinion, may be isolated survivors of a group which had its origin in the northern hemisphere rather than on an antarctic land-mass or on a land-bridge between Africa and South America.

Genus **Myopias** Roger

Myopias tasmaniensis sp. nov.

(Fig. 1.)

Worker. Length 3.8-4 mm.

Head subrectangular, as broad as long, slightly narrower behind than in front, with nearly straight sides and feebly, broadly concave posterior border. Eyes very small and flat,

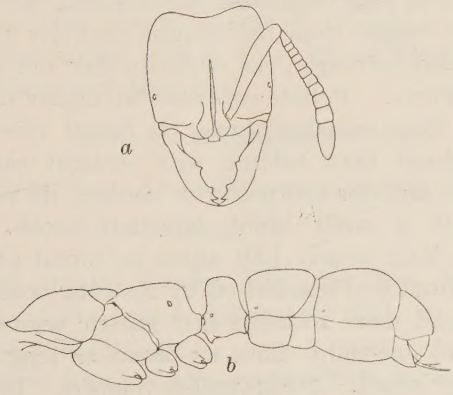

Fig. 1. *Myopias tasmaniensis* sp. nov. worker. *a*, head from above; *b*, thorax and abdomen in profile.

situated more than their own length from the posterior border of the clypeus, consisting of hardly more than 15 minute, crowded

[1]Psyche 30, 1923 p. 16, Fig. 2.

ommatidia. Mandibles long and narrow, convex and deflected, their external border straight in the middle, the apical border with four teeth (counting the terminal), the most basal small, acute and erect, near the middle of the border, the next somewhat larger and blunter and the preapical small and close to the terminal tooth. Clypeus very short, vertical, and transverse, above with a short, shelf-like, projecting, rectangular lobe immediately under the frontal carinæ. The latter with prominent, closely approximated lobes, their posterior continuations short and subparallel. Frontal groove deep and broad, extending back somewhat beyond the middle of the head. Antennal scapes reaching to within about twice the diameter of their tips from the posterior corners of the head; funiculi long, thickened distally, first joint about one and one-half times as long as broad, not as long as the three following joints together; these and the remaining joints, except the last, distinctly broader than long, the four terminal joints forming a distinct club. Thorax narrower than the head, with rather straight dorsal outline in profile, interrupted at the pronounced promesonotal and mesoëpinotal sutures; pronotum broader than long, somewhat rounded above and on the sides; mesonotum transversely elliptical, nearly twice as broad as long; epinotum subcuboidal, the base straight and distinctly longer than the abrupt declivity with which it forms a rounded rectangle, the declivity flat, not marginate on the sides or above. Petiole subcuboidal, higher and somewhat broader than long, rounded above; in dorsal view trapezoidal, narrower in front than behind, with straight sides and very feebly concave anterior and posterior borders, its ventral surface anteriorly with a small, blunt, lamellate tooth. Postpetiole broader than long, nearly half again as broad as the petiole, truncated in front and marked off by a strong constriction from the broader and more rounded first gastric segment, which is about one and one-third times as broad as long. Remaining segments very small. Sting well-developed. Legs long and rather stout; middle and hind tibiæ each with a well developed spur, the one on the hind tibiæ larger.

Very smooth and shining; mandibles with a few scattered punctures; clypeus transversely rugulose; cheeks finely punc-

tate; upper surface of head, thorax, petiole, postpetiole and first gastric segment rather coarsely punctate, the punctures being smallest and most numerous on the head, largest and least numerous on the thorax and node and intermediate in size and density on the postpetiole and gaster. Legs rather finely and indistinctly punctulate.

Hairs yellow, sparse, erect or suberect, longest on the gaster; short, abundant and subappressed on the appendages. Pubescence long, distinct only on the dorsal surface of the head.

Deep ferruginous brown; clypeus and borders of mandibles darker; legs paler, dull brownish yellow.

Described from two specimens taken by Mr. A. M. Lea at Hobart, Tasmania.

This species seems to be very close to the two other known species of the genus. It differs from *amblyops* in possessing an additional tooth on the mandibles, from *cribriceps* in having a shorter head and petiole and smaller eyes, and from both in having a small rectangular shelf-like lobe which projects from the upper part of the clypeus immediately under and between the lobes of the frontal carinæ. This last character is of peculiar significance since a similar though longer rectangular projection is one of the peculiarities of Trapeziopelta Mayr, a genus in other respects very closely related to Myopias, as Emery has remarked. One might, indeed, go so far as to regard Trapeziopelta as a subgenus of Myopias.

Genus **Acanthoponera** Mayr

Acanthoponera (*Anacanthoponera*) *imbellis* Emery

(Fig. 2.)

Acanthoponera imbellis Emery, Ann. Soc. Ent. Belg. 39, 1895, p. 346 ♀ ; Gen. Insect. Ponerinæ 1911, p. 36 ♀ ; Forel, Ark. Zool. 9, 1915, p. 10 ♀ .

The typical form of this species was originally described from Kamerunga, Queensland, but seems to be widely distributed in Australia. Forel has recorded it from Adelaide, South Australia (E. Mjöberg), and I have seen specimens taken by Mr. A. M. Lea at Port Lincoln and Gawler in the same com-

monwealth. Emery gives the length of the type specimen as 2.75 mm. My specimens are somewhat larger (3.2 mm.) and Forel's measured 3-3.2 mm. The petiole when viewed from above is decidedly broader than long, the postpetiole and gaster are decidedly shining, the former densely punctate, with super-

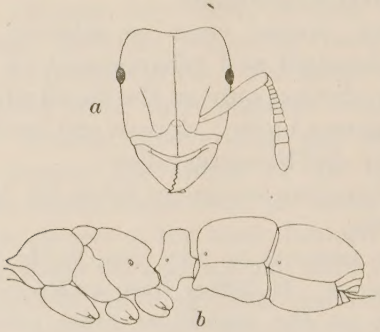

Fig. 2. *Acanthoponera* (*Anacanthoponera*) *imbellis* Emery, worker. *a*, head from above *b*, thorax and abdomen in profile.

imposed, scattered, larger punctures, or foveolæ, which have sharp anterior borders so that they are somewhat "eingestochen", to use a German expression. The color appears to be rather variable, the gaster being sometimes dark brown like the head or like both the head and thorax, sometimes paler brown with only the head dark.

Var. *hilaris* Forel.

Ectatomma (*Acanthoponera*) *imbellis* var. *hilare* Forel, Ann. Soc. Belg. 39, 1895, p. 421 ♀.

Acanthoponera imbellis var. *hilaris* Emery, Gen. Insect. Ponerinæ 1911, p. 10 ♀.

According to Forel, this variety, taken at Mackay, Queensland (Gilbert Turner), is larger than the type (3.6 mm.) and differs in sculpture as follows: "Abdomen densely punctate and subopaque. All the remainder densely and finely reticulate-punctate and opaque. Moreover, the front is coarsely longitudinally rugose, while the other portions of the head, the thorax

and petiole are covered with dense, superimposed foveolæ, in part reticulate or transformed into rugæ."

A single specimen taken at Sydney, New South Wales (A. M. Lea) agrees with this description.

Var. *scabra* var. nov.

Worker. Length 2.5-3 mm.

Differing from the typical *imbellis* and the preceding variety in having the petiolar node distinctly longer in proportion to its width. The sculpture of the head, thorax and petiole is coarser and the postpetiole and base of the first gastric segment, though feebly shining, are longitudinally reticulate-rugulose. The color is dark brown, with the mandibles, antennæ and legs brownish or reddish yellow. One specimen has the postpetiole and gaster paler and more reddish than the head and thorax.

Described from three workers taken by Mr. A. M. Lea at Sydney, New South Wales.

Acanthoponera (*Anacanthoponera*) *leæ* sp. nov.

(Fig. 3.)

Worker. Length 4 mm.

Head subrectangular, a little longer than broad and very slightly narrower in front than behind, the posterior border

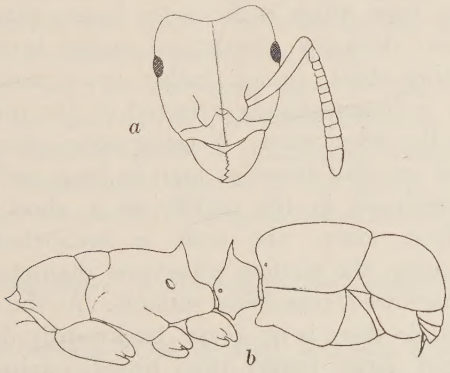

Fig. 3. *Acanthoponera* (*Anacanthoponera*) *leæ* sp. nov. worker. *a*, head, from above; *b*, thorax and abdomen in profile.

rather deeply and broadly concave, the sides feebly and evenly convex, the median longitudinal costa, or carina, extending back over the front and vertex, very pronounced. Eyes rather small, moderately convex, their anterior orbits just behind the median transverse diameter of the head. Mandibles large and broad, their external border rather straight in the middle, the terminal border with only three distinct large apical teeth, the more basal denticles appearing as mere undulations. Clypeus sharply carinate, its anterior border entire, broadly rounded and depressed; frontal area short and indistinct, with a median carina continuous with those of the clypeus and dorsal surface of the head; frontal carinæ separated as in *imbellis*, subparallel, scarcely reaching to the level of the anterior orbits, bordering a depressed area on each side for the accomodation of the antennæ. Scapes of the latter reaching somewhat beyond the eyes; funicular joints 2-7 subequal, transverse but less so than in *imbellis*, the three terminal joints forming an indistinct club, the last joint somewhat longer than the two preceding subequal joints together. Thorax in profile feebly rounded above, slightly more convex and broadest in the region of the pronotum, which is transversely subrectangular, with distinctly dentate anterior corners, the teeth being nearly as long as the width of their bases. Promesonotal suture subangular, distinct but not strongly impressed; mesoëpinotal suture obsolete. Mesonotum short, broader than long, somewhat semicircular. Epinotum with nearly straight base which is distinctly longer than the abrupt, slightly concave declivity, the lateral angles between the two surfaces forming stout, broad, rather acute and erect teeth. The declivity is longitudinally grooved in the middle but not marginate on the sides below. Petiolar node cuneate in profile, about one and one-half times as high as long, narrowed above, its summit produced in the middle as a short, stout, erect spine; seen from above the node is somewhat hexagonal, broader than long, the median transverse diameter corresponding with the narrowed, transverse summit. At the anteroventral end of the petiole there is an acute, backwardly directed tooth. Postpetiole very large, longer than broad, narrowed in front, where its anterior surface is abruptly truncated and concave, its

sides convex, its anteroventral edge with a transverse tubercle. Gaster small and short, much smaller than the postpetiole, the first segment convex above, semicircular, scarcely longer than broad, enveloping the remaining segments which are very small and together form a downwardly directed cone. Sting small. Legs rather long and stout; tarsal claws simple.

Opaque; mandibles somewhat shining, finely striate and coarsely punctate, the striæ and punctures more numerous near the apical border. Clypeus finely and indistinctly punctate-rugulose. Head between and behind the frontal carinæ coarsely and divergently longitudinally rugose, with coarse punctures, or foveolæ in the interrugal spaces; sides of head with the rows of foveolæ more distinct. Thorax, petiole, postpetiole and first gastric segment coarsely rugose and foveolate, the rugæ vermiculate and reticulate on the pronotum and petiole, longitudinal on the mesoëpinotum, including the epinotal declivity, mesopleuræ, postpetiole and first gastric segment, most sharply on the two latter regions. Terminal gastric segments smoother and somewhat shining; scapes and legs subopaque, densely punctate.

Hairs yellow, fine, uneven, rather abundant and rather short, erect or suberect on the body; the appendages covered with abundant, fine, rather appressed hairs with fewer, interspersed, long, erect hairs.

Deep castaneous brown; mandibles, scapes, tip of gaster and legs, excluding the coxæ, yellowish brown; apical borders of mandibles and median carina of head black.

Described from two specimens taken by Mr. A. M. Lea in the National Park, near Sydney, New South Wales.

This very distinct species is interesting because, unlike the other known Australasian species of the genus, it approaches the Neotropical *mucronata* in the armature of the petiole.

Acanthoponera (*Anacanthoponera*) *brouni* Forel

Acanthoponera brownii Forel, Mitteil. Schweiz. Ent. Zeitschr. 8, 1892, p. 330 ♀ ; Emery, Gen. Insect. Ponerinæ 1911, p. 36 ♀ .
Acanthoponera brounii Forel, Trans. New Zealand Inst. 37, 1904, p. 353 ♀ .

This species was described from specimens taken by Major Thos. Broun at Drury, near Auckland, New Zealand. Forel originally spelled the gentleman's name "Brown" and named the species "brownii" but corrected the error in 1904. Emery in the "Genera Insectorum" questions the advisability of this procedure. I can only record my conviction that such obvious taxonomic blunders should be corrected and not propagated indefinitely in the literature in a spirit of silly pedantry.

Subsp. *kirki* subsp. nov.

(Fig. 4.)

Worker. Length 2.3-3 mm.

Smaller than the typical form of the species, which measures 3.2-3.5 mm. The head is not coarsely but very finely and indistinctly rugulose. The declivity of the epinotum is strongly concave, its lateral marginations enlarged above to form blunt but distinct teeth. The color differs from that of the type as

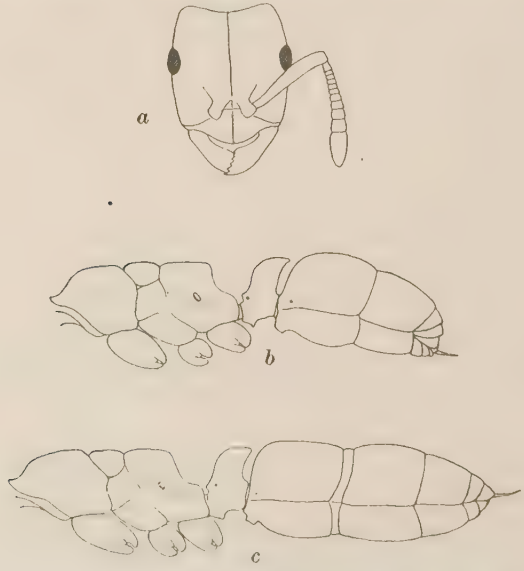

Fig. 4. *Acanthoponera* (*Anacanthoponera*) *brouni* Forel subsp. *kirki* subsp. nov. *a*, head of worker from above; *b*, thorax and abdomen of same in profile; *c*, thorax and abdomen of ergatomorphic female in profile.

follows; Body ferruginous red; mandibles, clypeus, mesonotum and gaster brownish yellow; dorsal surface of epinotum, the petiole and posterior borders of postpetiole and gastric segments dark brown; coxæ and legs pale yellow, knees and tarsi reddish.

Female. Length 3.2 mm.

Wingless and ergatomorphic, differing from the worker only in its slightly larger size, in possessing small ocelli, in having the marginations of the epinotal declivity more rounded and less dentate above and in the larger abdomen, the postpetiole and first gastric segment especially being more voluminous. The color of the body is also different, the pronotum being darker then the meso- and epinotum, the petiole, postpetiole and gaster reddish brown like the pronotum, with the posterior borders of the segments brownish yellow. The anterior is somewhat paler than the posterior half ot the head.

Described from numerous workers and a single female which I took Sept. 5, 1914 from a single colony, comprising about 100 individuals in the Waitakari Forest, near Auckland, New Zealand. The ants were nesting under a dead branch of one of the huge kaori trees (*Agathis australis*), which was lying on an exposed root of the tree from which it had fallen. When first disturbed the workers were quite active but on being touched curled up and "feigned death". Similar behavior was observed by Hetschko in the Brazilian *A. dentinodis*, according to Mayr. The single female, described above, was evidently the mother queen of the colony, which had a number of small larvæ. These resembled the larvæ of Ectatomma in being smooth, that is nontuberculate, and in being covered with dense, soft hairs. The subspecies is dedicated to Prof. H. B. Kirk of Victoria University, Wellington, the memory of whose kindness during my sojourn in New Zealand I shall always cherish.

The occurence of a single ergatomorphic female as the mother queen of *kirki* is of interest, because so few females of Acanthoponera have been taken, and because in the Neotropical *dentinodis, dolo* and *mucronata* all the recorded individuals were of the typical winged type. But Emery in 1906 found two individuals like the workers but with more voluminous abdomens among specimens of the Chilean *carinifrons*. One of these,

with the larger abdomen, was paler in color than the workers, with higher petiole and more pubescent legs and gaster. He regarded this individual as an ergatoid female and the other as a form transitional to the normal worker. That he was correct in his assumption is shown by the foregoing observations on *kirki*. Whether such ergatomorphic females ever co-exist with winged forms in the same species or colony will have to be determined by future observations.

I insert here a list of the American species and varieties of Acanthoponera with their synonymy and known distribution:

Acanthoponera (*Anacanthoponera*) *carinifrons* (Mayr)

Heteroponera carinifrons Mayr, Verh. zool. bot. Ges. Wien 37, 1887, p. 533 ♀; Dalla Torre, Cat. Hymen. 7, 1893, p. 43 ☿.

Acanthoponera carinifrons Emery, Ann. Soc. Ent. Belg. 39, 1895, p. 347 ☿; Bull. Soc. Ent. Ital. 37, 1906, p. 112 ☿ ♀; Gen. Insect. Ponerinæ 1911, p. 36 ♀ ♀.

Type locality: Valdivia, Chile.

Chile: Coipué, San Vicente (F. Silvestri); Corral (R. Thaxter, my collection).

Acanthoponera (*Anacanthoponera*) *dentinodis* Mayr.

Ectatomma (*Acanthoponera*) *dentinode* Mayr, Verh. zool. bot. Ges. Wien 37, 1887, p. 541 ☿ ♀ ♂; Emery, Bull. Soc. Ent. Ital. 26, 1894, p. 143, 144 ☿.

Ectatomma dentinode Dalla Torre, Cat. Hymen. 7, 1893, p. 24 ☿ ♀ ♂.

Acanthoponera dentinodis Emery, Gen. Insect. Ponerinæ 1911, 0p. 36, ☿ ♀ ♂.

Type locality: Santa Catharina, Brazil (Hetschko).

Bolivia (L. Balzan); Brazil: Novo Friburgo.

Var. *inermis* Emery.

Ectatomma (*Acanthoponera*) *dentinode* var. *inerme* Emery, Bull. Soc. Ent. Ital. 26, 1894, p. 143 ♀.

Acanthoponera dentinodis var. *inermis* Emery, Gen. Insect. Ponerinæ 1911, p. 36 ♀.
Type locality: Rio de Janeiro, Brazil.

Var. *panamensis* Forel.

Ectatomma (*Acanthoponera*) *dentinode* Forel var. *panamense* Forel, Biol. Centr. Amer. Hymen. 3, 1899-1900, p. 9 ☿.
Acanthoponera dentinodis var. *panamensis* Emery, Gen. Insect. Ponerinæ 1911, p. 36 ☿.
Type locality: Volcan de Chiriqui, 3000 ft., Panama (Champion).

Acanthoponera (*Anacanthoponera*) *dolo* (Roger).

Ponera dolo Roger, Berlin. Ent. Zeitschr. 4, 1860, p. 293 ☿ ♀.
Ectatomma (*Acanthoponera*) *dolo* Mayr, Verh. zool. bot. Ges. Wien 12, 1862, p. 733; *ibid.* 37, 1887, p. 540.
Ectatomma dolo Dalla Torre, Cat. Hymen. 7, 1893, p. 24 ☿.
Acanthoponera dolo Emery, Bull. Soc. Ent. Ital. 37, 1906, p. 112 ☿; Forel Verh. zool. bot. Ges. Wien 1908, p. 342 ☿; Emery, Gen. Insect. Ponerinæ 1911, p. 36 ☿ ♀; Forel, Ann. Soc. Ent. Belg. 56, 1912, p. 34 ☿; Bruch, Revist. Mus. La Plata 19, 1914, p. 214 ☿ ♀; Gallardo, An. Mus. Nac. Hist. Nat. Buenos Aires 30, 1918, p. 18 ☿ ♀; Luederwaldt, Notas Myrmecologicas, São Paulo, 1918, p. 6.
Type locality: Brazil (Schaum and von Olfers).
Brazil: Bella Vista, Paraná (F. Silvestri); São Paulo (von Ihering); Prov. Rio Janeiro (Goeldi); Ilha de S. Sebastião, Alto da Serra, Salto Grande, Ituverava, São Paulo (H. Luederwaldt).
Argentina: Puerto Piray, Misiones (F. Silvestri).

Var. *aurea* Forel.

Acanthoponera dolo var. *aurea* Forel, Bull. Soc. Vaud. Sc. Nat. 49, 1913, p. 203 ☿ ♂; Bruch, Revist, Mus. La Plata 19, 1914, p. 214 ☿; Gallardo, An. Mus. Nac. Hist. Nat. Buenos Aires 30, 1918, p. 20 ☿ ♂. Fig. 1.
Type locality: Misiones, Argentina (C. Bruch).

Var. *schwebeli* Luederwaldt.

Acanthoponera dolo var. *schwebeli* Luederwaldt Revist. Mus. Paul. 1918, p. 54 ♀; German transl. São Paulo 1920, p. 3 ♀; Notas Myrmecologicas, São Paulo 1918, p. 6.
Type locality: Alto da Serra, São Paulo, Brazil (E. Schwebel)

Acanthoponera goeldii Forel.

Acanthoponera goeldii Forel, Ann. Soc. Ent. Belg. 56, 1912, p. 34 ♀.
Type locality: Prov. Espiritu Santo, Brazil (Goeldi).

Subsp. *schwarzi* subsp. nov.

(Fig. 5.)

Worker. Length 4.5 mm.

Agreeing well with Forel's description of the type but smaller, with the petiolar spine as long as the epinotal spines and apparently directed somewhat more upward. The epinotal spines diverge and their downward deflection is feeble. There is no constriction between the postpetiole and gaster. The color seems to be paler, being brownish yellow, the postpetiole and

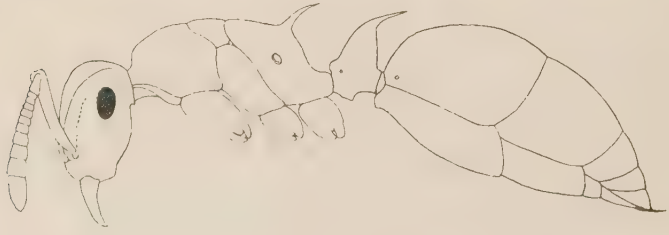

Fig. 5. *Acanthoponera goeldii* subsp. *schwarzi* subsp. nov. Worker, lateral aspect.

gaster lighter than the head and thorax (darker in the typical *goeldii*), as pale as the legs, only the overlapping posterior borders of the segments brown. Judging from the description of *goeldii*, the sculpture of the head, thorax and petiole is finer and more indistinct and the postpetiole and gaster are not aciculate, but very finely and superficially punctulate. Pubescence on these

latter regions conspicuously long. The frontal carinæ with their accompanying scrobes extend to the posterior corners of the head and there curve downward and forward to terminate under the eyes, as in the typical *goeldii*.

Described from a single specimen found running on a cacao tree at Trece Aguas, Alta Vera Paz, Guatemala by Messrs. E. A. Schwarz and H. S. Barber.

This may be a distinct species, but as I have seen no specimens of the typical *goeldii*, with the description of which it agrees in quite a number of characters, it may stand provisionally as a subspecies.

Acanthoponera mucronata (Roger).

Ponera mucronata Roger, Berlin. Ent. Zeitschr. 4, 1860, p. 299 ☿ ♀.

Ectatomma (*Acanthoponera*) *mucronatum* Mayr. Verh. zool. bot. Ges. Wien 12, 1862. p. 962; *ibid.* 37, 1887, p. 540; Emery, Bull. Soc. Ent. Ital. 26, 1894, p. 143 ♀; Forel, Biol. Centr. Amer. Hymen. 3, 1899-1900, p. 9 ☿ ♀.

Ectatomma mucronatum Dalla Torre, Cat. Hymen. 7, 1893, p. 25 ☿ ♀.

Acanthoponera mucronata Emery, Gen. Insect. Ponerinæ 1911, p. 36 ☿ ♀. Pl. 2, Fig. 2; Forel, Ann. Soc. Ent. Belg. 56, 1912, p. 34 ☿; Luederwaldt, Notas Myrmecologicas, São Paulo 1918, p. 6. Type locality: Brazil (von Olfers).

Brazil: Matto do Governo, São Paulo (H. Luederwaldt); Corcovado, near Rio de Janeiro (A. Müller); Matto Grosso.

Var. *minor* Forel.

Ectatomma (*Acanthoponera*) *mucronatum* var. *minor* Forel, Biol. Centr. Amer. Hymen. 3, 1899-1900, p. 9 ☿.

Acanthoponera mucronata var. *minor* Emery, Bull. Soc. Ent. Ital. 28, 1896, p. 33 ☿; Gen. Insect. Ponerinæ 1911, p. 36 ☿. Type locality: Teapa en Tabasco, Mexico (H. H. Smith).

Costa Rica: Suerre (A. Alfaro).

Var. *wagneri* Santschi.

Acanthoponera mucronata var. *wagneri* Santschi, Bull. Soc. Vaud Sc. Nat. 54, 1921, p. 84 ♀.

Type locality: Banderas, 55 km. north of Icaño, Chaco de Santiago del Estero, Argentina (E. R. Wagner).

The following key may serve for the identification of the workers of the various forms of Acanthoponera mentioned in this paper:

1. Claws tridentate; epinotum armed with spines; petiole terminating above and behind in a spine; constriction between postpetiole and gaster feeble or absent (subgen. *Acanthoponera* sens. str.).....2

   Claws simple; epinotum at most dentate or subdentate; petiole (except in *A. leæ*) unarmed or merely with a median tooth or projection behind; constriction between postpetiole and gaster well-developed. (subgen. *Anacanthoponera* subgen. nov.).....6.

2. Frontal carinæ and adjacent scrobes extending around the posterior corners of the head and terminating under the eyes; funicular joints 2-5 at least twice as broad as long; epinotal spines curved downward.....3.

   Frontal carinæ and scrobes terminating at posterior corners of head; scapes more slender, funicular joints 2-5 somewhat broader than long.....4.

3. Petiolar spine shorter than the epinotal spines; constriction between postpetiole and first gastric segment distinct; these segments aciculate, subopaque. Length 4.9-5 mm. (Brazil)..... *goeldii* Forel.

   Petiolar spine as long as the epinotal spines; constriction between postpetiole and first gastric segment absent; these segments shining, finely punctate. Length 4.5 mm. (Guatemala)..... subsp. *schwarzi* subsp. nov.

4. Epinotal spines curved inwards. Length 8 mm.; female 10 mm. Postpetiole and first gastric segment punctate-rugulose, subopaque. (Brazil)..... *mucronata* (Roger.)

   Length 6 mm. or less.....5.

5. Anterior corners of pronotum angular; epinotal spines straight and divergent; postpetiole and gaster shining and sparsely punctate. Length 6 mm. (Argentina). var. *wagneri* Santschi.
   Anterior corners of pronotum more rounded; petiolar spine somewhat more erect. Length 5.3mm. (Mexico). var. *minor* Forel.
6. Australasian species; dark brown ..... 7.
   Neotropical species; black, brownish yellow, or brownish red ..... 12.
7. Petiole armed with an erect spine above; anterior corners of pronotum dentate. Length 4 mm. (New South Wales). *leæ* sp. nov.
   Petiole unarmed, anterior corners of pronotum rounded. Length less than 4 mm ..... 8.
8. Petiolar node concave behind, the posterior border of its summit distinctly produced backwards ..... 9.
   Petiolar node truncated behind, its posterior border not produced ..... 10.
9. Larger (3.2-3.5 mm.); head coarsely rugose; epinotum scarcely dentate (New Zealand) ..... *brouni* Forel.
   Smaller (2.3-3 mm.); head finely and distinctly rugose; epinotum more distinctly dentate; legs paler. (New Zealand) ..... subsp. *kirki* subsp. nov.
10. Front of head rather finely rugose; postpetiole and gaster shining, punctate and sparsely foveolate. Length 2.75-3.2 mm. (Queensland; South Australia). *imbellis* Emery.
    Front of head more coarsely rugose; postpetiole and gaster subopaque ..... 11.
11. Postpetiole and gaster densely punctate. Length 3.6 mm. (Queensland; South Australia) .... var. *hilaris* Forel.
    Postpetiole and first gastric segment longitudinally reticulate-rugose. Stature smaller (2.5-3mm.). (New South Wales) ..... var. *scabra* var. nov.
12. Black; petiole without a distinct tooth on its posterior border. Length 3.3-3.7 mm. (Chile) .. *carinifrons* Mayr.
    Brownish yellow or brownish red; petiole usually armed with a distinct tooth or projection ..... 13.

13. Frontal carinæ as long as the antennal scapes.....14.
Frontal carinæ much shorter, reaching only to the level of of the eyes.....16.
14. Sculpture coarse. Length 3-4.2 mm. (Brazil, Bolivia), ...*dentinodis* Mayr.
Sculpture finer.....15.
15. Petiolar tooth reduced to a mere convexity (Brazil). var. *inermis* Emery.
Petiolar tooth distinct; pubescence more abundant; color deeper. (Panama).....var. *panamensis* Forel.
16. Teeth of epinotum and petiole distinct.....17.
Teeth of epinotum and petiole absent. (Brazil)..... *dolo* var. *schwebeli* Luederwaldt.
17. Larger (5-5.5 mm.); anterior surface of petiolar node more rounded; legs with numerous suberect hairs (Brazil, Argentina).....*dolo* Roger.
Smaller (4.5) mm.; anterior surface of petiolar node more angular in profile above; thorax less convex; legs only with appressed or subappressed hairs; pubescence more brilliant and golden (Argentina).....var. *aurea* Forel.

NOTES ON THE EGG-EATING HABIT OF BUMBLEBEES.[1]

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Among the older treatises on the biology of bumblebees, that of the Swiss biologist Huber (1802) occupies a preëminent position, partly because it is more comprehensive than those of earlier workers, but chiefly on account of the many new observations which are described by the author. Among other things, Huber (pp. 259-260) relates that, while engaged in egg-laying, the bumblebee queen is frequently molested by the workers who try to steal the newly-laid eggs in order to "drink the milky juice", and that the queen repels such offenders with great fury. About eighty years later, Huber's (1802) account was confirmed by the well-known Austrian bumblebee student Hoffer (1882-83), and a few years later also by Härter (1890, pp. 62-65). Hoffer (I, pp. 12-14) describes this interesting phase in the life-history of the bumblebee colony as follows: "While engaged in egg-laying, the queen usually is severely molested by the workers and the so-called small queens (and if she be one of the latter, even by the old queen), while the males, although coming into close proximity, do not cause the slightest trouble. In the case of *B. lapidarius*, I frequently observed small queens, or also common workers, force their heads between the cell-wall and the dorsal side of the abdomen of the egg-laying individual in the attempt to snatch the freshly-laid eggs from the cell******, an endeavor in which they frequently succeeded to the great vexation of the egg-laying queen.*******

"The proper number of eggs having been laid, the queen quickly withdraws her abdomen from the cell, and turning about quickly, first of all drives away the most obtrusive workers and other females, and closes the cell with wax*******; if the remaining individuals approach too close, she quickly makes an example by seizing the boldest individual with her legs and mandibles and engaging in a rough and tumble fight with her for a few moments, during which both individuals sometimes tumble

[1]Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 232.

to the floor over the other members of the colony. She then leaves the individual which has been chastized, and frequently severely bitten in this manner, and quickly returns to the cell to protect it against the onslaughts of others; occasionally, however, she is already too late, for some of the more active individuals have meanwhile opened it [the cell], and have taken out several eggs and devoured them.

"Punishment is almost always meted out only with the legs and mandibles, and the [chastized] individual, conscious of her guilt, does not even attempt to defend herself, all of her efforts being directed toward a hasty escape. This punishment sometimes is so severe that the poor creature is seriously wounded or even killed.*****.

"When, after such interruptions, the egg-laying queen has again returned to the cell,******she opens the latter with her mandibles and lays more eggs******, molested in the same manner as before*****; egg-laying completed, she remains near the newly-laid eggs for several hours. *******

"The attacks of the other individuals become less and less frequent, and finally cease altogether; and these same little insects which previously tried their very best to destroy the newly-laid eggs, now become attentive guardians and devoted nurses of their embryo brothers and sisters; they keep them warm and provide with tender solicitude for their nourishment."

Some twenty years after the publication of this description, the Russian psycho-biologist Wagner (1907) published a comprehensive treatise on bumblebees, in which he denies the correctness of Hoffer's (1882-83) observation, because Wagner (p. 90) found that whenever he opened an egg-cell in one of his bumblebee colonies, the workers invariably repaired the damage without molesting the eggs[2]. Only once did Wagner (pp. 90; 111-112)

[2]In regard to these experiments of Wagner (p. 90), it may be stated that more than a century before it was discovered by Huber (1802) that bumblebee workers seldom show a desire to rob eggs after the latter are a day old. Huber (p. 260) says: "It seems that the old eggs are less sought after by the workers than those which are newly-laid; indeed I have seldom seen workers attack them the second day.

"I once tried to offer them old eggs just as they were attacking the fresh ones; they carefully closed up the first without attempting to eat them."

It seems probable therefore that the eggs which Wagner (p. 90) used in his experiments were not newly-laid eggs.

observe that an egg was sucked dry by a worker, but he believes that this was entirely due to the fact that the egg was accidentally injured, and that the worker, after having tasted the sweet juice, found the latter suitable as food. "If", says Wagner (p. 88), "this affair [the fight for the eggs] took place in the manner described by the author, bumblebee colonies could never become as populous as they actually are, since the eggs would be inevitably destroyed by one of the workers as soon as the queen takes up the pursuit of other obtrusive workers; this [the destruction of the eggs] naturally takes considerably less time than is required for a rough and tumble fight****, and for rolling about on the floor******. During such encounters not only one, but five 'batches of eggs' can be despoiled." Wagner (pp. 88-89) therefore comes to the conclusion that Hoffer (1882-83) permitted himself to be deceived by the usual excitement among the members of a bumblebee colony when the latter is exposed to light.

Opposed to this negative evidence of Wagner (1907), we have the further positive evidence of Sladen (1912, pp. 51-52) who states that this fight for the eggs may be witnessed in the case of *Bremus* (*Bombus*) *lapidarius* and *Bremus terrestris* at the time the male and queen eggs are laid[3], a statement which, as I have shown recently (1922a, p. 28), also applies to one—if not all—of our American species.

We now come to the more difficult task of interpreting this race-suicidal habit of bumblebees. After describing this unnatural (from the human standpoint) practice of bumblebee society with considerable detail, Huber (pp. 260-261) gives way to the following reflexions: "What is to be thought of Nature, when she seems to give to insects the faculty of destroying their own species, when she permits hivebees to kill their males, and gives bumblebees the right and the desire to devour the newly-laid eggs?

[3]That "the fight for the eggs" probably occurs only at this period of the life-history of bumblebee colonies, is corroborated by my own observations (1922a, p. 28), and partly also by those of Harter (1890) and Lindhard (1912). Although I had about fifty incipient bumblebee colonies under close observation during the summers of 1922 (cf. 1923) and 1923, I failed to find any trace of such habit in the colonies during this period of their development.

"Would it not seem natural to conclude that she wishes to bring about total destruction? However, the species are conserved, the colonies multiply, the laws are not changed; on the contrary, it seems that is it by the sacrifice of a few that the conservation of the species is assured. Special observations show us that the hivebees only kill their males when the latter have become useless to their colony; they [the males] would consume a large quantity of provisions which the bees need for nourishment during the winter; and Nature prefers the conservation of the industrious ones to that of the males which no longer render any service after the time of reproduction.

"As for the pillage of the eggs of bumblebees, one must seek the cause further.

"It doesn't seem of any usefulness to the colony itself; for the eggs which are subject to the gluttony of the workers are as much the eggs of the workers as eggs of males and females.

"But perhaps the Author of nature wished to diminish the number of 'mellivores' in that way.

"The bumblebees are the largest insects that feed on honey; and if their number trebled or quadrupled, other insects would not find any nourishment, and perhaps their species would be destroyed.

"This argument will have more force, if we notice with what care Nature has put limits on too great a population of bumblebees. These insects have several kinds of enemies; among others a pseudomoth and a big white caterpillar which feed on their wax, their pupæ, and sometimes themselves; they are even burdened with a numerous family of lice which attach themselves to their thorax, and which they carry off with them in the air."

Although describing the egg-eating habit of bumblebees in great detail, Hoffer (1882-83) offers no explanation of this habit. However, a few years later, the well-known French bee student Pérez (1889), who was much interested in the observations of Hoffer (1882-83), ventured to discuss this interesting question. After quoting a large part of Hoffer's (I, pp. 12-14) description, Pérez (p. 110 ff.) goes on to say: "But this return to better feelings [on the part of the workers] cannot make us forget

the wildness of the instinct which carried them away at a certain instant. That is one of the most astonishing habits among those which we owe to the observations of Hoffer, and one of the most inexplicable which the biology of bumblebees presents. That the egg-laying queen energetically defends her offspring, is such an ordinary and natural act that it cannot surprise us. As for the acquired instinct [of destroying the eggs], that is the natural consequence of the momentary cannibalism of the disappeared ones [instincts] when the indifferent mother abandoned her eggs to the voracity of her first-born. But why this fratricidal instinct, this passing madness, which for an instant interrupts and somewhat mars the upright and honest life of bumblebees? Indeed, in the case of the hivebee, we sometimes see the workers destroy, and without doubt also devour the eggs. But that only happens at a time when honey is abundant in the flowers, when the care of storing up as many provisions as possible, obliges them to sacrifice these objects of such tender solicitude ***. Here [in the case of bumblebees] the guilty ones have no such excuse. We are actually confronted with a case of plain gluttony. A freshly-laid egg is undoubtedly a delicacy which gives off an irresistable fragrance. That is perhaps all that we need to see in this habit; an imperfection of the social instinct which selection has not succeeded in correcting. The necessity of restricting too great a multiplication of the colony, cannot be entertained for a moment [as a possible explanation]. Here, as in the case of the hivebee, and elsewhere, a large population means riches and power. And if nature wished to moderate the increase, she had—without speaking of parasites -a much more simple and less savage means; that of restricting*****the number of eggs in the ovaries of the queen.

"That is not all. If we suppose that a restriction in the number of eggs is advantageous -which in some way would justify the fratricidal instinct of the workers—, of what use is the instinct of the mother which impels her to defend her eggs, an instinct which is diametrically opposed to the first? Why two instincts, not only contrary, but even contradictory? And if we accept that the voracity of the workers requires a corrective that the maternal instinct of the queen be from that time useful

to the species, we must agree that its adaptation is very defective. It would be better that the mother, less impetuous, would not leave the cell for an instant and would not engage in a fight with the agressors. Not a single egg would be lost, and the covetousness of the evil-intentioned ones would not be satisfied. How are we to unravel this chaos? I give it up, as far as I am concerned. We delude ourselves, I believe, in wishing to seek perfection everywhere in nature, and under all conditions. Let us recognize that all is not for the best in the realm of the bumblebees anymore than in other realms."

Twenty-three years after the publication of this rather pessimistic speculation of Pérez (1889), another explanation was suggested by the late F. W. L. Sladen (1912).

After having given a detailed description of this strange habit of bumblebees in the first part (pp. 51-52) of his admirable treatise on bumblebees, Sladen (p. 257) says: "I think that the strange race-suicidal habit the *lapidarius* workers have of attempting to devour their mother's new-laid eggs is associated with the parasitism of *Psithyrus*. It is natural to suppose that workers that attempt to devour the eggs of their *Psithyrus* step-mother perpetuate their egg-devouring instinct through their sons that they sometimes succeed in rearing. In support of this view it is interesting to note that in nests of *B. latreillellus*, a species that is not preyed upon by any species of *Psithyrus*, I have never seen the queen's eggs molested by the workers."

As I have already pointed out elsewhere (1922a, p. 28), this explanation does not seem very plausible. It is a well-known fact that ants, even those belonging to species which are not molested by parasitic ants, frequently eat their own eggs (cf. Wheeler, 1910, p. 332). Moreover, I have frequently seen the workers of *Bremus fervidus* eat their mothers' eggs, and this species (cf. Plath, 1922b) probably does not suffer any species of *Psithyrus* to breed in its nests, a view which is supported by a large number of records (10 by Putnam (1864), "a large number" by Franklin (1912-13), and 33 by the writer) of *fervidus* nests, none of which were victimized by a Psithyrus.

In the same year in which Sladen (1912) published his work, another explanation was offered by the Danish biologist

Lindhard (1912). After quoting a part of Hoffer's (1882-83) description and giving a brief resume of Pérez' (1889) explanation, Lindhard (pp. 347-349) describes his own observations as follows:

"The *lapidarius* nest which is shown in Fig. 4 was without any wax covering or any other roof during the warm weather from the 10, to the 20-22, of August. When the lid of the box was opened and a glass plate removed, one could see all that took place in the nest. The bees did not let themselves be disturbed by the light[4]. Each evening, from about 4 o'clock until 7, egg-laying could be observed. Besides the old queen, as a rule, 2-4 large workers laid eggs, each one in her low, poorly-formed wax-cell. Generally there were 2-3 such small pots in use at the same time*****. The egg-laying workers were very uneasy, but did not bother one another very much, and only seemed to be shoving each other about in order to get a chance to lay eggs. If one succeeded in shoving another away from the cell, she, as a rule, took the other one's place. They [the workers] could also be seen shoving the queen about while she was engaged in egg-laying, but I did not see any worker try to take her eggs. Once she ran from one cell to another without closing the eggs, but a small worker went over at once and closed the cell without touching an egg. The queen however seemed nervous and jealous when one of the small females [workers] tried to lay eggs near her. I saw her one day shove a female [worker] away from a cell, carefully examine the eggs in the cell throw out three of them, bite the fourth one to pieces, and, after having chewed it together with a little pollen, lay it on top of a cell of a queen larva. The three other eggs were turned over and examined by two small workers and were dragged away.

"That was another explanation! Those were the unfertilized eggs which were used as food for the young queen larvæ.

"In the bumblebee colony the army of workers comes first[5], in constantly increasing numbers, the individuals of each new batch being larger than those of the preceding one. The last

[4]This contradicts one of Wagner's (1907, pp. 88-89) assertions to which reference was made in the earlier part of this paper.

[5]This, as I have shown recently (1923, p. 332), is not always the case.

large workers or small queens in several species approach the old queen in size, and more or less of them lay eggs which are normally unfertilized. After these come the males, frequently in a large, homogeneous batch; but after this, the production of males in nests with a strong queen is very small. The young queens come forth 6-10 days after the males, and the production of queens continues as long as the old queen and the workers are in full strength, even if there are produced at the same time some workers and males. The number of large, egg-laying workers in a strong colony is now quite considerable. They lay only male eggs, and if all their eggs hatched, the number of males would be steadily increasing and would be many times as large as the number of young queens. But this is not the case; so there must therefore be some other use for these eggs, and, it seems, they must be used for food, and only those larvæ which receive such an extra albumen-rich food, become queens.

"If this theory is correct, *Bombus* and *Psithyrus* species are more closely related to each other than is generally believed. *Psithyrus* is accused of feeding its larvæ with the eggs of bumblebees and all of its own fertilized eggs become queens."

This explanation, in my opinion, seems to be the most plausible, and is very suggestive. If Lindbard's (1912) hypothesis is correct, we have here a similar state of affairs as in the case of certain ants (cf. Wheeler, 1910, p. 332) where the destruction of eggs insures the preservation of the species.

In this connection a few words may be said in regard to the food of hivebee larvæ. Dr. E. F. Phillips (1921, p. 111) has the following to say on this subject: "The feeding of the larvæ is one of the most ardently disputed questions in bee activity. The chief controversy arises over the source of the food, some authors claiming that it is a secretion of glands, while others maintain that it is regurgitated from the ventriculus." It seems that none of the investigators whom Dr. Phillips (pp. 111-116) mentions, have considered the possibility that the so-called royal jelly with which hivebees feed their queen larvæ may, at least in part, consist of malaxated eggs[c], a surmise which is

[c]That hivebees sometimes destroy eggs is asserted by Pérez (1899) in one of the preceding extracts.

further suggested by the similarity in color between this food-paste of hivebees and their eggs.

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NOTES ON THE CAPE COD BROOD OF PERIODICAL CICADA DURING 1923.

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The Cape Cod brood of *Tibicen septendecim* L. has been one watched with great interest since the early colonial days of Massachusetts, and it was during those days that it first came to the attention of the colonists who were then settling in and around Plymouth.

Early this year (1923) Dr. H. T. Fernald of the Massachusetts Agricultural College called my attention to the fact that the Periodical Cicada was due to appear on the Cape this season, and he asked me to observe the brood, to get some idea of its range and abundance.

The first record I obtained was on June 13th when Dr. H. J. Franklin of the Cranberry Experiment Station at East Wareham, gave me several specimens of *T. septendecim* which had been given to him the day before. The gentleman who brought them in said that he found them in abundance near Pocasset, Mass., in the town of Bourne.

On June 15th I went to that territory and struck into the woods for a distance of a half mile when I came into the infested area. This was one mile east of Monument Beach (a part of Bourne). It may be interesting to note at this point that part of this territory had been burned over by a tremendous forest fire on May 23rd-26th (inclusive), 1923, and that the brood appeared first in the burned area. On reaching this territory I met Mr. Lumbert who owns a considerable amount of land there. He told me that the Cicadas had been out for about two weeks (making the first appearance on or about June 1st). Examination of the burned area showed "chimneys" all over the ground, some of them partially charred, indicating that they had probably been constructed prior to the invasion of the forest fire. In many cases the chimneys were very numerous, one to a square foot of ground where they were thickest.

The "active pupæ" were emerging until about June 22d, the height of the emergence apparently coming from about the 16th to the 19th. At this time, during the evenings, tremendous swarms of immature forms came out of the ground and ascended any upright object within range. Mr. Lumbert claimed to have seen several nymphs come out of a single chimney during this time. He also told me he had found active pupæ in the spring, about 18 inches below the surface of the ground. The adults were usually all on the wing by the morning following nymphal emergence.

On June 20th my attention was called to another part of the brood in Plymouth, between that place and Manomet on a ridge known locally as The Pine Hills. On the same date, I received reports of Cicadas infesting territory from Falmouth east to Osterville; and on Wing's Neck, which is a part of Bourne extending westward into the waters of Buzzards Bay. On June 21st two specimens were taken in East Wareham near the State Cranberry Bog.

The area of infestation of the Cape Cod brood for 1923 may be described as follows:

Town of Plymouth.—From the southern end of the village (Plymouth proper) southeast to Manomet and west from there to Great South Pond; a second area around the northern end of Great Herring Pond.

Town of Wareham.—Eastern corner.

Town of Bourne.—The whole town more or less, the heaviest infestation occurring on the south side of the Cape Cod canal from Bourne High School eastward to Sagamore and southward to Bourne-Falmouth town line, and westward to within one mile of the Coast line of Buzzards Bay except at Wings Neck, where the infestation came to the water's edge.

Town of Falmouth.—Whole town except from Falmouth village to Woods Hole where only a few specimens were taken after full emergence had taken place to the northward.

Town of Sandwich.—Whole town except a strip one to two miles wide along Cape Cod Bay.

Town of Mashpee.—Whole town.

Town of Barnstable.—Southern half of town.

Town of Yarmouth.—Whole town except a strip about one to one and a half miles wide along Cape Cod Bay.

The heaviest infestations were in the Plymouth Pine Hills central and southern part of Bourne, northern, central and eastern Falmouth, Mashpee, southern Barnstable, central Sandwich and central Yarmouth.

Individual, lone specimens were taken at East Wareham, Ellisville (southeastern Plymouth), Woods Hole, Harwich, and Carver indicating, possibly, the former existence of parts of this brood in those sections. Fishermen from Woods Hole said that Cicadas could frequently be found floating in the ocean south of the Falmouth shore. I obtained no record of any on the Islands. (Nantucket or Marthas Vineyard).

Older inhabitants of the village of East Wareham tell me that they remember two broods previously when the insect was abundant in the village.

Mr. Lumbert of Monument Beach called my attention to a "big green beetle" which was preying on adult Cicadas and I asked him to collect some for me if he found more. This he did, and I found that it was the Calosoma beetle, *C. sycophanta* L. Later, in company with Prof. W. H. Sawyer, of the Department of Biology, Bates College, I took several Calosomas in the act of capturing Cicadas.

The order of emergence for this brood, as nearly as I can make out, is as follows: 1st week in June at Bourne; 2nd week in June at Falmouth, Mashpee, Sandwich, Yarmouth, Barnstable, and Plymouth (south of village); 3rd week in June at Plymouth (north of Great Herring Pond).

In driving through the infested territories south and east of the Cape Cod Canal, on July 11th, I found that by far the greatest damage done by this brood of *T. septendecim* L. occurs in the eastern part of the town of Falmouth, around the village of Waquoit. Here the insect has deposited its eggs in practically every suitable plant, including ferns, false indigo and goldenrod. Almost every oak from one to twenty feet high has dead and dying twigs hanging from it in abundance. In several cases I saw oaks twelve feet high and three or four inches through at the base with foliage entirely brown, and much of the youngest

growth already drooping. A list of plants attacked is herewith submitted. I suspect many more could be added to the list by other observers, but the following have come to my attention: *Aster* spp. (Wild Asters), *Baptisia tinctoria* (False indigo), *Linaria canadensis*, *Myrica asplenifolia* (Sweet Fern), *Prunus serotina* (Black Cherry), (*Prunus cuneata*) (Plum), *Pteris aquilina* (Common Brake), *Pyrus Malus* (Apple), *Quercus illcifolia* (Scrub Oak) and *Quercus rubra* (Red Oak), *Robinia Pseudo-Acacia* (Locust), *Solidago* spp. (Goldenrod), *Vaccinium* spp. (Blueberry and huckleberry), *Viburnum cassinoides*, *Vitis* sp. (Grape).

Quercus ilicifolia (scrub-oak) is the favorite host for oviposition in every case, but lack of room on the oaks, and lack of oaks have driven the females to laying in practically any woody plant available.

One of the interesting points in this season's occurrence of the Cicada, is the uneven emergence through the whole brood; often sections of the brood but a few miles distant from one another emerging at different times. Another interesting feature is the "patchy" occurrence throughout the area of infestation. Some places are heavily infested and others within the suspected area are practically free from the insect, although the same host plants and the same soil conditions exist in both cases. The digging of the Cape Cod Canal has disrupted part of the brood, as no Cicadas could be found within 100-500 feet of the canal banks.

About July 1st dead Cicadas could be picked up frequently in the infested area and by July 11th, dead and dying Cicadas could be found in abundance. By the middle of July very few living specimens could be found in Bourne, but the section of the brood around Great Herring Pond was still in full operation.

STUDIES IN ASILIDÆ (DIPTERA)[1]

By A. L. Melander.

Pullman, Washington.

While the June-August issue of Psyche, containing a review of the genus *Cyrtopogon*, was in preparation a similar study by C. Howard Curran appeared in the Canadian Entomologist, April to October. In the paper in Psyche I described seven new species of *Cyrtopogon*, and Curran's paper included twelve new species. This curious coincidence in the selection of a genus for review might have resulted in unfortunate additions to synonymy, but such is not the case, for among the nineteen new species described neither Curran nor myself chanced upon the same forms.

Two reflections are pertinent in this connection. First, there should be some clearing house where investigators could report their intended activities and thus be notified if the field is preempted. Possibly the National Research Council will in time function in this capacity for all America, or better for all nationalities. With reference to my own studies twice before have other workers independently selected the same groups for review, referring to Malloch's Agromyzidæ and to Cresson's Sciomyzidæ, which papers were in the printers' hands coincidentally with manuscripts of mine. Second, the fact that two workers discover nineteen new species in a well-known genus of an eagerly sought family without conflicting with each other shows that much more is still to be done in systematic dipterology than we are wont to realize.

With regard to the two new genera described by Curran both have a slender, tapering, third antennal joint with long style. *Comantella* was established for two species, *cristata* Coquillett and *fallei* Back, hitherto assigned to *Cophura*, and because *fallei* was regarded as the same as *Cyrtopogon maculosis* Coquillett the last-named species was designated as the genotype.

[1]Contribution from the Zoology Laboratory of the State College of Washington.

I have nineteen specimens of *Cyrtopogon maculosis*, in none of which is there a trace of the curved claw-like spur at the apex of the front tibiæ. I also have another specimen, almost indistinguishable from the others, which has the spur strongly developed. This last specimen I refer to *fallei* in the genus *Comantella*. *C. fallei* has the fork of the third vein located before the posterior crossvein and the anterior crossvein at nearly three-fourths the length of the discal cell. Its bristles are stronger, the pygidium longer and the thoracic gibbosity more compressed than in *maculosis*, which has the anterior crossvein at the middle of the discal cell and the fork of the third vein opposite the end of this cell. *Maculosis* is referable to Curran's new genus *Eucyrtopogon*. The genotype of *Comantella* is therefore *fallei* Back, synonym *maculosis* Curran, not Coquillett. Instead of being a highly variable character the terminal claw-like spur maintains its dignity as an "atavic index" to the two main subdivisions of both the Dasypogoninæ and the Laphrinæ.

Key to the North American Species of Cophura.

Wings dark; abdomen and legs more or less reddish.....2.
Wings more or less hyaline; abdomen black or blue-black, with pollinose spots.....4.

2. Three deep black stripes on notum, the middle one geminate; wings uniformly brown; abdomen reddish-yellow. (Mex.) .....*sodalis* O. S.
Thoracic stripes brownish; wings in part clear toward apex.....3.

3. Legs black, the knees, base of tibiæ and part of tarsi yellow; abdomen brown-black, the hind margins of segments narrowly reddish. (Mex.)....*humilis* Will.
Legs reddish, anterior femora darkened on outer posterior side; abdomen red, laterally white pruinose. (Tex.) .....*bella* Lw.

4. Pollinose marks of abdomen large, extending along sides and more or less across front part of segments; tibiæ reddish.....5.

Lateral pollinose marks of abdomen not extending across front part of segments ..... 7.

5. Wings clouded on crossveins and furcations, base of second submarginal cell truncate and with a spur of a vein ..... 6.
Wings hyaline, no spur at fork of third vein, anal cell closed and petiolate. (Cal.) ..... *clausa* Coq.

6. Anal cell open. (Cal.) ..... *trunca* Coq.
Anal cell closed in the margin; lateral pollinose marks of abdomen each with central black shining spot. (Cal.) ..... *highlandica* Cole.

7. Legs red; oral and trichostical bristles black. (Wash., Or., Wyo. ..... *brevicornis* Will.
Legs entirely black ..... 8.

8. Oral bristles black ..... 9.
Oral hairs white ..... 10.

9. Crossveins and furcations tinged with brown; pruinosity of thorax brownish, bristles pale, scutellar margin narrowly black and with six pale hairs; abdominal segments scarcely pruinose at base. (Wash., Or.) ..*scitula* Will.
Wings clear hyaline; pruinosity of thorax grayish, bristles black, scutellar margin broadly black and with two short black setæ; abdominal segments with basal pruinose fascia. (Id.) ..... *melanochæta*, n. sp.

10. Wings tinged with brown; mesonotum marked with brown broad geminate median stripe and lateral spots. (Mex.) ..... *pulchella* Will.
Wings nearly or wholly hyaline; mesonotal pattern nearly obsolete ..... 11.

11. Mesonotum nearly bare; pygidium white-pruinose. (Ariz.) ..... *fur* Will.
Mesonotum whitish pilose; pygidium polished. (*cyrtopogona* Cole) (B. C., Wash., Or.) ..... *albosetosa* Hine.

The genus *Cophura* has been heterotypic, serving to combine various species that run to it in the keys, without regard to their phylogeny. The separation of *Comantella* helps to unify the group, but it is still diverse. The species are considered rare, only the type material being known of most of its forms. I

have taken *brevicornis* near Spokane, in the Olympic Peninsula and near Mount Adams, in Washington; at Portland, Oregon; and in the Yellowstone Park. I have also taken *scitula* at Portland, Oregon, and *albosetosa* at Yakima, Washington. The preceeding key differentiates the species assigned to *Cophura*.

Cophura melanochaeta, new species.

Male.—Length 6.5 mm. Black, head and thorax cinereous pollinose, abdomen marked with silvery pruinose fasciæ on segments 2-5 and round pruinose spots on hind angles of segments 1-5. Facial hairs sparse, white, oral bristles strong and black, a row of black setulæ along frontal orbits, occipital hairs and setæ white; basal joints of antennæ rounded, with strong black inferior setæ, third joint widest beyond middle, three times the length of either basal joint, the style three-jointed, including its apical peg-like joint as long as a basal joint of the antennæ. Mesonotum with dense pollen, darker gray in center, its vestiture short black recumbent setulæ, lateral bristles black, base of scutellum heavily light-gray pollinose, only two short black apical setæ, middle of metanotum lightly pollinose. Abdominal hairs inconspicuous, pale, those at base of the small pygidium dark; ventral segments mostly shining black, each gray-fasciate at base and apex. Leg bristles black, hairs pale, inside of distal half of hind tibiæ and of basal two joints of hind tarsi thickly yellow pubescent. Halteres yellow; wings entirely hyaline, veins black, clear-cut, fork of third vein a little beyond discal cell, anterior crossvein slightly beyond middle of discal cell, anal cell open.

Female.—Length 10 mm.

A pair taken at Waha, Idaho, 12 Aug. 1923; another female, Moscow Mt., Idaho, Jul. 8.

Key to the Species of Metapogon.

Legs in part reddish; wings more or less clouded on crossveins.....2.

Legs black, at most knees reddish; wings not marked about crossveins; antennæ black.....4.

2. Antennæ black; anterior crossvein at middle of discal cell; pluræ with golden spots. (Cal.).....*pictus* Cole.
   Base of antennæ yellow; anterior crossvein beyond middle of discal cell.....3.
3. Abdomen with large triangular pollinose marks; bristles yellow; femora reddish. (Cal.).....*gilvipes* Coq.
   Abdomen polished, with gray pruinose spots at base of segments 2-6; bristles black; femora black except knees. (N. Mex.).....*punctipennis* Coq.
4. Mainly black, abdomen with small pruinose spots; wings of male white on basal half, lightly infumated apically, of female uniformly lightly infumated; mystax stiff and black. (Wash., Id., Or., Cal.).....*setiger* Cole.
   Body mainly cinereous, base of abdominal segments black; wings hyaline; mystax white. (Wash.)..*albulus*, n. sp.

Metapogon albulus, new species

Male.—Length 7 mm. Black, entirely and heavily coated with silvery gray pruinosity, leaving only the bases of abdominal segments showing black. Bristles of face and front white, ocellar bristles black; third antennal joint widest at three-fifths its length, the style almost microscopic, setæ below basal joints of antennæ black; beard sparse and white, upper part of occiput bare except for the row of white setæ. Bristles of anterior part of thorax white, of posterior part black, four or five stout bristles in dorsocentral row, posthumeral bristle present, white, two supraalar bristles, scutellum with two marginal bristles, otherwise bare, two to five hypopleural setæ, pleuræ devoid of pile except on prothorax. Pile and setæ at sides of first abdominal segment white, remaining segments with very sparse short white hairs, base of segments two to five very narrowly devoid of pruinosity, hypopygium small black and inserted in the end of the cylindrical abdomen, its hairs pale and rather sparse; venter entirely glaucous. Legs black, the coxæ alone pruinose, knees very narrowly yellowish, femora with a few small white flexor bristles, bristles of tibiæ white except those at apex, tarsal bristles black, claws black, pulvilli brownish, hairs of legs

sparse short and white. Halteres yellow; wings almost hyaline, veins dark brown, becoming paler at root, hind margin closely fringed with fine hair, anterior crossvein at two-fifths the length of the discal cell, anal cell open.

Female.—Bases of abdominal segments two to six with broader black fasciæ, seventh segment lightly black, venter with triangular black denuded marks increasing in size posteriorly, the sixth segment entirely black, some of tibial bristles blackish.

Types.—Six specimens Pullman, Washington, and Collins, Idaho (C. V. Piper) July and August. Type in collection of State College of Washington.

Key to Species of Dioctria.

Femora wholly black, the tibiæ alone sometimes reddish...2.
Femora and rest of legs wholly or largely yellow or red; mystax pale.....11.

2. Mystax fulvous and dense; body brilliant greenish black. (Cal.).....*resplendens*, Lw.
Mystax generally black, rarely white, if fulvous not dense; body less brilliantly metallic.....3.

3. Third joint of antennæ one and one-half times the length of the two basal joints together and cylindrical (*Banksi* Johns.).....4.
Third joint of antennæ subequal to basal joints together...5.

4. Legs wholly black. (Va.).....*Banksi* Johns., s.str.
All tibiæ reddish on basal half. (Va.)..var. *tibialis* Banks

5. Legs wholly black.....6.
Tibiæ more or less reddish-yellow.....9.

6. Wings yellowish on basal half, blackish on apical half. (Cal.).....*parvula* Coq.
Base of wings not markedly yellowish.....7.

7. Upper plate of hypopygium wide, with two broad lobes; fulvous coat of mesopleura extending along upper edge only. (Eastern U. S., doubtful if in West)..*albius* Walk.
Upper plate of hypopygium narrow, pronged but not with flat lobes.....8.

8. Upper plate divided into two long tapering parts ending in a knob-like enlargement, with a tooth on inner surface and a pencil of yellow hair on outer edge (N. Y.; N. Car.) ..... *brevis* Banks

Upper plate a slender finger-like undivided projection about four times as long as wide and with parallel sides, lateral arms short and heavy. (Cal.; Wash.) *media* Banks

9. Tibiæ except tips reddish-yellow; notum heavily coated with fulvous, abdomen metallic violaceous; large species, 11-13 mm ..... 10.

Only base of tibiæ yellowish; mesopleural pollen extending down along posterior edge; face of male silvery, of female golden; 7-9 mm. (Wash., Id.,; doubtful if East) ..... *sackeni*, form *rivalis* new

10. Mesopleural pollen along upper edge only; face of both sexes brassy. (Cal., Wash.) ..... *nitida* Will.

Mesopleura with dense fulvous pollen and pile extending down along posterior edge; face of male silvery. (Cal.) ..... *doanei*, n. sp.

11. Abdomen wholly black; femora with black line above.... 12.

Abdomen in part reddish, at least with lateral spot or incisures reddish; femora wholly yellow; thorax polished black ..... 14.

12. Mesonotum densely coated with golden pollen; wings largely yellow. (Ida., Wash., Or.; if eastern in distribution, probably dimorphic form of *albius* Walk.) ..... *sackeni* Will.

Mesonotum thinly coated with yellow pollen, leaving two narrow black lines ..... 13.

13. Face silvery, mystax white; wings hyaline. (Eur.; Mass.) ..... *baumhaueri* Mg.

Face golden, mystax yellow; wings dark. (Cal.) *vera* Back

14. Coxæ black; abdomen reddish, first four segments more or less black; arista one-sixth the third antennal joint; wings blackish. (Cal.) ..... *rubida* Coq.

Coxæ yellow; style one-fourth to one-half the third antennal joint; wings lighter; hind metatarsus swollen, equal to next three joints in length ..... 15.

15. A yellowish pollinose stripe extending from base of wings to front coxæ; abdomen dull rufous, segments with indistinct black near middle; arista one-fourth the third antennal joint. (Cal.) ..... *pleuralis* Banks.
    Pollinose spot above front coxa disconnected; arista longer ..... 16.
16. Abdomen largely dull reddish; legs reddish. (Cal., Col.) ..... *pusio* O. S.
    Abdomen largely black, legs pale yellow 17
17. Abdomen black and yellow banded. (Or. Wash.) ..... *vertebrata* Cole
    Abdomen narrowly fasciate with reddish and with red spot on sides of second segment. (Wash.) ..... *henshawi* Johnson

Dioctria doanei, new species.

Male. Length 14 mm. Robust, black, abdomen bronzed, tibiæ luteous, vestiture dense, yellow. Face silvery, mystax black, vertex and occiput golden, hairs yellow; antennæ elongate, black, third joint a little longer than the basal two together. Thorax coated with fulvous pollen, especially pronounced on posthumeral areas, scutellum black, lateral bristles of notum fine and yellow; meso- and sternopleuræ largely polished. Anterior part of abdominal segments 2-4 sunken, pile of apical segments appressed, deep golden, becoming almost reddish beneath pygidium. Legs strong, hind femora robust, coxæ, femora, tips of tibiæ, and tarsi black, bristles of tibiæ and tarsi reddish, pulvilli brown, claws black. Wings strongly and uniformly infumated, discal cell widened apically, anterior crossvein before its middle and fork of third vein just beyond its end, sixth vein curving forward, anal cell narrowly open; halteres yellow.

Two specimens collected by Professor R. W. Doane at Pasadena, California, June 6, 1895. Type in collection of the State College of Washington. The dense pilosity and constricted abdominal segments suggest *Dicolonus*, but the head is different, the vertex being deep-set and the face flat.

Dioctria sackeni, new form **rivalis.**

Male.—Length 7 mm. Basal half of wings smoky hyaline, distal half merging into blackish; legs black, the anterior knees and the basal half of hind tibiæ reddish yellow. Face entirely silvery, mystax, hairs of front, of antennæ and of upper occiput black, vertex with scant fulvous coating and not golden. Coating of mesonotum fulvous and not heavy, hairs black; the golden patch in front of wing connected with the more silvery patch on upper sternopleura. The appressed hairs on posterior half of abdomen black, not golden as in form *Sackeni*; dorsal plate of hypopygium continued posteriorly as two long narrow clavate processes, each tipped without by a closed cluster of black bristles and bearing on inner side of knob a pronounced parallel-sided prong, long black hairs on ventral lip and on stout lateral valves. In *Sackeni* hairs fringing the ventral lip are brown.

Female.—Length 8 mm. Face deep golden. Wings uniformly blackish. Legs black.

Morphotypes.—Priest Lake, Idaho, Aug. 1920; Coeur d'Alene, Moscow Mt., Avon, Id.; Big Fork, Mont.; Friday Harbor, Quilcene, Wash.; Nelson, B. C. (Melander): Stuart Island, Wash. (H. S. Davis); Wolf Fork of Touchet River, Wash. (V. Argo). Thirty-two specimens.

Late one afternoon while collecting insects at Priest Lake, Idaho, I noticed many specimens of a *Dioctria* running over the foliage of some alder bushes growing near the water's edge. On mounting the captured specimens there were found to be seven males of *D. Sackeni*, four males of the present black form and nine black females. The only interpretation is that *Sackeni* is dimorphic in the male sex. I have also taken the lighter colored male of *Sackeni* together with the dark female at Nelson, B. C.

Light-colored males, similar to *D. Sackeni*, have been found associated with the dark *albius* in several places in the East. Dr. Back ventured the opinion that *Sackeni*, therefore, might prove to be the same as *albius*, but the recent note by Banks that the Eastern reddish males have genitalia of the *albius* structure suggests that male dimorphism in *Dioctria* is probably

extended to several species. The Pennsylvania female with hyaline wings recorded by Johnson in Psyche, 1918, p. 103, as undoubtedly belonging to *Sackeni*, is more likely a distinct species.

Neopogon salinus, new species.

Male.—Length 9 mm. Entirely densely covered with whitish-gray pollen, abdomen incompletely fasciate with blackish-gray. Antennæ cinereous, the style three-fourths the length of the third joint, mystax, hairs and postvertical row of bristles white. Hairs of mesonotum short and white, slightly longer on sides, scutellum bare; a few hairs on propleuræ, pleuræ otherwise bare, about eight setiform hairs in hypopleural row. First, fourth and eighth abdominal segments almost wholly whitish-gray, remaining segments with transverse blackish-gray marking, pile and bristles at sides of first segment white, hypopygium small, silvery, and white pilose, the hood-like covering pink and penicillate below, venter white-gray, bare at base, last four segments with double brush of yellowish-white hairs directed to the middle and covering a subshining space. Legs as heavily coated as body, nearly bare of hairs, bristles mainly white, claws, empodia and some of tarsal bristles black, pulvilli white. Halteres whitish yellow. Wings hyaline, with very faint yellowish tone, veins black, yellowish at base, neuration normal.

Female.—Length 10 mm. Darkened markings of abdomen present on second to sixth segments, ovipositor, *i. e.* eighth ventral segment, shining beneath, tarsal bristles all white.

Types.—Six specimens collected by Dr. J. M. Aldrich at Great Salt Lake, Utah, July 31, 1908. Type, allotype and two paratypes returned to the Aldrich collection. The species runs to *N. Coquilletti* in Bezzi's table (Ann. Hung. Mus. 8. 147-153, 1910) but that species has the abdomen colored as in the familiar *N. trifasciatus*, with a strong white band on fourth segment, the second and third segments dull black, and the fifth, sixth and seventh segments shining black.

Nicocles punctipennis, new species

Length 12 to 13 mm. Black species, with hyaline wings marked with dark spots around the discal cell and with brownish clouds at the tips of the veins. Fifth segment of male about twice as wide as deep, its front border and the sixth segment silvery. Last three segments of the female abdomen respectively with a pair of gray pruinose triangles, a pair of squares, and entirely gray pruinose. Hind tarsi of male silvery within. Antennal style one-third the length of the third joint. Three strong lateral presutural bristles, two supra-alar, two or three postalar.

Male.—Face, front and occiput gray-white pruinose; facial hairs fine, white, comparatively dense, extending to the antennæ, long below, bristles of mystax yellowish, oral, ocellar, and postocular bristles yellowish brown; beard and palpal hairs white; face nearly square, and but little convex. Antennæ black, the basal segments subequal, and provided with white hairs, the second segment with a conspicuous light brown bristle below, the third segment nearly twice as long as the basal joints together, slender, cylindrical, little tapering, three times as long as the thick style. Upper side of the thorax with an irregular gray-brown pattern, showing gray, however, on the narrow median entire stripe, on each side of which is a narrow line, abbreviated posteriorly and on the humeri, scutellum, a large square prescutellar spot, with a triangular space on each side, and a curved sutural stripe extending up above the root of each wing. This sutural stripe does not continue across the notum, but stops on the row of dorsocentral bristles, where it connects with gray horns from the anterior angles of the prescutellar spot. The brown color is not uniform, and is darkest as an interrupted vitta crossing the interior end of the gray sutural stripe. The oval center of the prescutellar spot is denuded and shows the polished black ground color of the thorax. Mesonotal hairs very fine, and rather sparse and long, pale yellowish, the posterior bristles pale, with brownish base: disc of the scutellum with white hairs, the margin with two cruciate bristles. Pleuræ and coxæ gray pruinose, the center of the mesopleuræ alone brownish; trichostichal hairs long, numerous, and whitish;

halteres black, their stem brown. Abdomen flat, shining black except for the gray lateral margins of the basal three and a half segments, and the silvery tip, which occupies the whole of the last segment and the anterior part of the fifth. On this segment the silvery band is broadly emarginate behind, so that it occupies but one-fourth of the segment at the middle, and then curves down to the hind angles; this segment is but little more than twice as broad as deep. The vestiture of the abdomen consists of very sparse, appressed, golden hairs and longer erect white hairs growing from black pittings on the gray lateral marks. The venter is gray, speckled with brown at the root of each hair. Legs with appressed whitish pubescence and with yellowish bristles, the inner side of the hind tarsi and of the end of the hind tibiæ with dense silvery hairs, anterior tibiæ rufous, rest of legs black in ground color. Wings hyaline, but with dark brown spots located at the very root, on the crossveins, bordering the ends of the veins at the wing-tip, and across the wing at the base of the discal cell as a much interrupted band, broadest and darkest in the marginal cell. The hyaline anal cell is closed in the margin, the posterior cells all open, and the fork of the third vein is broken at the base of the second submarginal cell, and there provided with a spur.

Female.—Differs in that the gray covering is less pure, but sullied with brown on the face, front, pleural sclerites and venter. The end of the abdomen lacks the silvery pruinosity, but instead, the fifth segment has lateral gray triangles, the sixth is gray except for a median stripe, and the seventh is completely gray. The pubescence of the legs is duller and there is none of the silvery ornamentation.

Types.—Male, Wawawai, Washington, May 1, 1909 (Wm. M. Mann). Two females from same locality, April 10 and 23, and two from Wallula, Washington, April, 1923 (P. G. Putnam.) A female paratype collected by E. L. Jenne, at North Yakima, Washington, September 18, 1903, is in the collection of the Washington State College.

This large and distinct species can be quickly recognized in the male by the concave silvery mark on the fifth abdominal segment, and in the female by the spotting of the wings as well

as by the maculation of the abdomen. In Coquillett's key (page 385, Back monograph, 1909) it goes to the last couplet, but does not conform with either *argentatus* or *æmulator*. The recently described *N. utahensis* Banks likewise goes to the last couplet of the key but differs from the present species in weaker chætotaxy, blacker thorax, and, apparently, much smaller size.

A NOTE ON THE NESTING HABITS OF *TACHYTES DISTINCTUS* Sm.

By Phil Rau.

St. Louis, Missouri

A bank at Creve Coeur Lake, composed of sand and soil, contained in a space of six by twelve feet, five nests of this species, on August 16, 1922. All of these domiciles had been established in burrows or openings made by other creatures or objects. Two nests were within the burrows made by rodents, one in an opening left in the soil by a disintegrating root, one in a crack in the bank, and the last in an opening made by a half buried sheet of tin. The mother wasp in each case gained access to her nest by these openings, which were unmodified and quite inconspicuous.

A careful study of these mothers revealed that it is the habit of these wasps to approach the opening by flight, accompanied by a noisy hum that resembles somewhat that of a horse-fly. She drops into her tunnel without preliminary search, or a pause at the doorway, but in a very businesslike manner she plunges in, remains a moment, then flies out and dashes off again. The same quickness characterises her movements, whether she is empty-handed or burdened with prey.

The prey is always a long-horned grasshopper of the species *Orchelimum vulgare* Harr[1]. It is carried on the under side of her body, held in position by her legs, and despite the fact that its size equals or sometimes exceeds her own, she has no difficulty in managing it, and is not even compelled to readjust it before entering the burrow. She does not experience the difficulty that many wasps do in entering the burrow with a large parcel, since the openings are always large.

The activities of one mother were watched closely, during which time she brought in four grasshoppers after hunts of 65, 55, 32 and 33 minutes respectively, and she took from three to five minutes each time to store them after she entered the burrow.

[1]The wasp was identified by Mr. S. A. Rohwer, and the hopper by Mr. A. N. Caudell.

An effort was made to excavate the burrows but the sandy soil was friable and in only one was the terminus successfully reached. This was the burrow under the sheet of tin; this sheet lay horizontally about ten inches under the surface of the soil, and by shoveling off this soil the sheet was removed and the tunnel exposed. It was found that her own gallery began about four inches from where she entered the opening beneath the tin. The tunnel ran horizontally and the tin served as its roof, leaving a miniature trench when the sheet was lifted; this trench ran in the shape of a quarter circle for about four inches, where it entered the ground and continued as a straight burrow for an additional distance of six inches, never at any point going down more than ¾ inch below the plane of the first portion. The diameter of the burrow of her own making was approximately ½ inch. One grasshopper was found at the end of the burrow. It lived about a day after its disinterment.

The most interesting feature about the nesting habits of this species is that, though they utilize the old burrows of other creatures, they use them only as a vestibule; but once under cover they dig their own tunnel in a way well becoming to industrious creatures. They do not, like certain other wasps, use ready made burrows for nesting purposes, but only use that site to conceal their nests from prying eyes, where they can work unhindered. My observations on the habits of this species would be incomplete if I failed to note the very interesting and significant characteristic, its ability to find out and utilize the beginnings of burrows, and thus gain safety and save labor.

Williams (Kans. Univ. Sci. Bull 8:194-197, 1913) finds that the entrance to a burrow of this wasp had a circular mound resembling "somewhat the appearance of a mud tube such as are made by crayfish." May this not actually have been a crayfish burrow that *Tachytes* used as a vestibule to her own tunnel? Williams also finds in Kansas, that the cells are strung along the main shaft in an irregular manner, and in twenty cells that he opened, fifty six acridians were found. Fifty one of these belonged to the tribe *Melanopli*, and the other five being *Ageneotettix deorum* and *Orphuella speciosa*.

WILLIAMSONIA LINTNERI (HAGEN), ITS HISTORY AND DISTRIBUTION

By R. Heber Howe, Jr.

Belmont, Mass.

A male of this unique species was supposedly figured, without name or description, in 1854 (Emmons, DeKay's Agric. N. Y. 5: Pl. 15.f.1) though the plate is inaccurate as to wing venation (triangle with cross vein) pattern of abdominal markings, and the superior abdominal appendages are shown as distinctly furcate. I feel confident that it was not intended for a figure of this insect. The species was first thought definitely referred to, but not described, by Hagen in 1867 (Stett. ent. Zeit. 28:91) under the title of *Diplax vacua*,—evidently based on two females collected in 1860, one at Lake Winnipeg and one from the Saskatchewan river (in litt. Hagen) by Robert Kellicott. Later in 1878 (Bull. Acad. Belg. (2) 45:187) Hagen described what he thought to be the same species from material collected at Center, (now Karner) N. Y., naming the insect *Cordulia lintneri*. The type, a male (No. 2840) was taken on May 27 (1874?), and a female (No. 2839) paratype on May 21 (1874?) by Dr. J. A. Lintner. In a later paper by Hagen (Psyche 5: 371-373. 1890) he again fully described the species, and figured (Pl. 1. fs. 10-17) both sexes, recording at the same time the two females taken by Kellicott which he had formerly named *Diplax vacua*, but here calls *Libellula vacua* and which he considered identical. He made however a significant remark that "It is very interesting that this apparently arctic species is found in eastern New York." In this article Hagen refers to four males and four females as taken by Dr. Lintner, but Dr. E. P. Felt writes me under date of October 17, 1922 that "Knowing what I do of Doctor Lintner, I doubt very much if he ever had four males and four females of this species, though I am unable to explain the significance of the numeral 4 preceding the sign for the male. I am inclined to think it must be a subnumber, though apparently Hagen published his record and

allowed it to suggest at least four individual males and four individual females. This data as we may infer from Hagen's letter was in manuscript for some time and he doubtless transcribed the labels just as they were and later forgot to call attention to the erroneous construction likely to be placed upon the numeral just before the sex sign or the possibility of any such thing may have escaped his attention." As the label reads V 27 4♂ is it not likely that it meant May 27, 1874, a date that would fit in well with the other facts? In 1895 (Journ. N. Y. Ent. Soc. 3:46) Dr. P. P. Calvert placed the species in the genus *Somatochlora*, and in 1907 (Cat. Coll. Selys 17:36) Martin referred it to *Dorocordulia*, and figures (f42) the male abdominal appendages from a photograph sent him of the type by Dr. E. P. Felt. In 1913 (Bull. Brooklyn Ent. Soc. 8:93-96) Mr. Wm. T. Davis proposed for the species a new genus *Williamsonia*, and figured the wings of a female found in the collection of the American Museum of Natural History, New York taken by John A. Grossback on May 4? at Paterson, N. J.

The two females from Manitoba are not *Williamsonia lintneri* (Hagen), but represent a different species, *Williamsonia fletcheri* Will. (Can. Ent. 55:96. 1923). The two specimens collected by Mr. C. H. Young at Mer Bleue, near Ottawa, Canada (48th Ann. Report Ent. Soc. Ont. 25:1915), and specimens collected last May at the same location are also *Williamsonia fletcheri* though somewhat intermediate and less distinct from *W. lintneri* than the Manitoba specimens which would have supplied better and more characteristic type material. In my opinion it would have been more appropriate to revive the nomen nudum *vacua* already applied to the species rather than propose a new name. The discovery of the two species explains the supposed two curious distributional "lakes" that have heretofore been attributed to *Williamsonia lintneri*, the distribution of which is now made clear.

2839. ♂. Center, N. Y. May 27, '?4, "a sandy pine woods region" (J. A. Lintner). Coll. State Mus., Albany, N. Y., Bull. Acad. Belg. (2) vol. 45, p. 187 (1878).

2840. ♀. Center, N. Y. May 21, '?4, (J. A. Lintner) Coll. Mus. Comp. Zool., ibid.

♀. Paterson, N. J. May 4, ??, "recorded 1908" (J. A. Crossbeck) Coll. Amer. Mus. Nat. Hist., Bull. Brooklyn Ent. Soc. vol. 8, p. 93, 1913.

♂ ♀ ♀. Concord, Mass. (E. L. Peirson) Coll. ♂Howe, Ent. News, vol. 26, p. 238, 1915, Coll. ♀Acad. Nat. Sci., Proc. Thoreau Mus. Nat. Hist. vol. 1, p. 41, 1915, ♀, destroyed.

♂. Framingham, Mass. May 6, 1911 (C. A. Frost) Coll. Boston Soc. Nat. Hist., Mem. Thoreau Mus. Nat. Hist. vol. 8, 1921.

♀. Dedham, Mass. May 20, 1912, "in low swampy woodland near Wigwam ice pond" (C. W. Johnson). Coll. Boston Soc. Nat. Hist., Ent. News, vol. 26, p. 238, 1915 and Proc. Thoreau Mus. Nat. Hist., vol. 1, p. 41, 1915.

♂. Sherborn, Mass. April 30, 1913, "taken in an opening in a scrubby woodland adjoining a wet meadow", (E. J. Smith), Coll. Smith, Psyche, vol. 24, p. 48, 1917.

♀ ♀. Blue Hills, Milton, Mass. May 13, 1916, "both localities were hilly, rocky and covered with at hick growth of oak, birch and little maple. There was also quite a bit of under-brush. *Both* streams drained a marsh. That is, they were both outlets for swamps, but in both cases the swamps were small. The streams, themselves, were more or less swift; their water was of that peculiar type, containing a large percentage of organic matter in solution," (W. J. Clench) Coll. Mus. Comp. Zool., Boston Soc. Nat. Hist., Mem. Thoreau Mus. Nat. Hist. vol. II, pt. 4, p. 53, 1919.

♂. Hopkinton, Mass. May 21, 1916. (C. A. Frost) Coll. Howe, ibid. sup. 8, 1921.

♂. Concord, Mass. May 20, 1918 (R. W. Howe, Jr.) Coll. Howe.

♂. Concord, Mass. June 1, 1919. (R. H. Howe, Jr.) Coll. Thoreau Mus. Nat. Hist., Concord, Mass.

♀. Middleton, Mass. May 29, 1920. (F. H. Walker) Coll. Peabody Museum, Salem, Mass., Mem. Thoreau Mus. Nat. Hist., vol. II. sup. 8, 1921.

♂. Stony Brook, West Roxbury, Mass. May 6, 1922. (W. J. Clench) Coll. Williamson; Hammonds Pond, Brookline, Mass., May 7, 1922 (R. H. Howe, Jr.) Coll. Howe.

♀. Rumford, R. I. May 11, 1922, "near Ten Mile River and Central Pond in "the shadow of Pine and Hemlock woods. . . . in low growth of scrub mostly oak. . . . .swampy with sphagnum and skunk cabbage growth, also checkerberry and other boreal life." (E. D. Keith) Coll. Howe.

♂ ♀ ♀. Stony Brook, West Roxbury, Mass. May 13, 1922, "were flying in the vicinity of a small pond, one of them on a hillside some distance from the water. This pond is a permanent one, surrounded by low land that is covered with water in the spring, and along one side is a bog with sphagnum and Drosera," (Students, Bussey Institution) Coll. Mus. Comp. Zool. Cambridge, Mass. ♀. Bos. Soc. Nat. Hist., ♀. Howe.

♂. High Rock, Summer Hill, Stoneham, Mass. April, 1, 1923, "in roadway and on rocks," (C. V. Blackburn), Coll. Howe.

♀. Bear Hill, Stoneham, Mass. April 20, 1923, (C. V. Blackburn) Coll. Howe.

♀. Bear Hill, Stoneham, Mass. May 5, 1923, (C. V. Blackburn) Coll. P. Garman, Conn. Agric. Expt. Station, New Haven, Conn.

The dates, as will be seen, range from April 1, to June 4, and undoubtedly the reason *W. lintneri* has been overlooked is because of its flight season when collectors are not alive to the presence of Odonata in the field. My own observations of the species bears out the above field notes of other collectors. I always find it a woodland species inhabiting the heighborhood of cold bogs and brook runs, and it alights generally on stones. The orange ring on each abdominal segment makes the insect particularly easy of identification in the field. Its larva is unknown.

NOTES ON THE NESTS OF ODYNERUS (ANCISTROCERUS) BIRENINACULATUS SAUSSURE.

By Charles W. Johnson.

Boston Society of Natural History.

Early in May, 1923, Mr. F. E. Zeissig, of Ware, Mass., brought me four nests of this interesting solitary wasp. The nests are irregular lumps of coarse hardened clay, built around small twigs, the leaves of the tree or shrub being sometimes imbedded in the clay. The cells are near the center, arranged somewhat radially and with a thin silky lining. The nest is figured by Viereck in the Hymenoptera of Connecticut, plate 4, figure 1.

Having secured this wasp only from nests, and as species of parasitic Diptera (Bombyliidæ) have been obtained from the nests of solitary wasps, I placed each nest in a separate jar and numbered these as the wasps began to emerge. Althouth irregular in form the nests varied but little in size, nests numbers 1 and 2 having a diameter of about 40 mm. and numbers 3 and 4 a diameter of about 35 mm.

Nest No. 1. Two males emerged May 14, gnawing their way through the hard dry clay; on the 15th to 18th one and two males appeared each day, until the 19th when four males and one female emerged; on the 26th another female appeared, and on the 28th two, making a total of 13 males and 4 females. The specimens emerged through 13 openings in the nest.

Nest No. 2. One male appeared May 15, three on the 17th and one on the 21st. On the 22d one female emerged and on the 23d an ichneumon parasite, *Acroricnus junceus* Cress., female. On the 24th two females emerged and on the 25th four, a total of 5 males, 7 females, and a parasite. They issued through six openings.

Nest No. 3. Two males emerged on May 21 and two on the 22d, one female on the 24th, one on the 25th, two on the 26th, and four on the 27th, a total of 4 males and 8 females. They emerged through nine openings.

Nest No. 4. The parasite, *A. junceus* (female), emerged on May 22, two male wasps on the 23d, one on the 24th, one female on the 27th, and two on the 28th, a total of 3 males, 3 females and one parasite. These emerged through seven openings.

The presence of a parasite in nest No. 4 can hardly account for so few wasps, for nest No. 2, with a parasite, had the same number of wasps as nest No. 3. *A. junceus* has also been bred from the potter wasp (*Eumenes* sp.) and from *Odynerus tigris* Sauss.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.

At the meeting of March, 1923, Prof. C. T. Brues showed some new photographs of insects in amber and gave a review of the present knowledge of amber insects and fossil insects in general. See Scientific Monthly vol. 17, pp. 289-304, (1923.)

Mr. Emerton exhibited his outfit for collecting spiders.

At the April meeting, Dr. J. W. Chapman gave a lecture on the animals of the Philippine Islands where he has lived for the past six years.

Mr. A. P. Morse told about his entomological experiences in Nebraska where, for several summers, he has been observing the grasshoppers that eat wheat and corn and also the binder-twine with which the grain is tied up.

At the meeting in May, Mr. O. E. Plath read a paper on the various theories in regard to the humming of bumblebees at the entrance to the nest. This was noticed as far back as 1665 and at first interpreted as a call to the other bees. Observation, however, has shown that its object is to ventilate the nest. See Psyche, vol. 30, pp. 146-154, (1923.)

Mr. R. F. Hussey described the development of the sucking mouthparts of the Hemiptera.

At the June meeting, Miss E. P. Butler described the development of pseudopodia on the first abdominal segment of several insects. These at first resemble the rudimentary legs but at an early stage their growth stops, they become enveloped by the growing parts around them and are eventually absorbed.

Prof. W. M. Wheeler gave an account of a recent visit to the Panama Canal Zone and the Galapagos Islands, referring especially to the large associations of insects that live in the hollow stems of various tropical trees.

PSYCHE

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